DIRECT TESTIMONY AND EXHIBITS OF

RYDER C. THOMPSON

ON BEHALF OF

THE SOUTH CAROLINA OFFICE OF REGULATORY STAFF

DOCKET NO. 2019-3-E

IN RE: ANNUAL REVIEW OF BASE RATES FOR FUEL COSTS OF

DUKE ENERGY CAROLINAS, LLC

Q. PLEASE STATE YOUR NAME, BUSINESS ADDRESS AND OCCUPATION.

A. My name is Ryder C. Thompson. My business address is 1401 Main Street, Suite 900, Columbia, South Carolina 29201. I am employed by the State of South Carolina as the Director of Utility Rates and Services for the Office of Regulatory Staff ("ORS").

Q. PLEASE STATE YOUR EDUCATIONAL BACKGROUND AND EXPERIENCE.

A. I received a Bachelor of Science degree in Mechanical Engineering Technology from the State University of New York. Before assuming the role of Director of Utility Rates and Services, I held the position of Manager of Nuclear Programs for ORS. Prior to joining the ORS, I was employed by the South Carolina Electric & Gas Company ("SCE&G") for eight (8) years supporting SCE&G's New Nuclear Development project at the V.C. Summer Nuclear Station. I was promoted to the position of Licensing Supervisor leading SCE&G's Inspection, Test, Analysis and Acceptance Criteria ("ITAAC") program. As the Licensing Supervisor, I managed a team of project engineers responsible for the ITAAC closure process, which involved verifying the units were built in accordance with the license requirements and submitting the results to the Nuclear

Regulatory Commission ("NRC") under 10 CFR Part 52. While at SCE&G, I received the Senior Reactor Operator Certification for the Westinghouse AP1000 nuclear power plant.

Prior to joining SCE&G, I was employed by General Dynamics Electric Boat Corporation ("Electric Boat") for eight (8) years supporting the design and construction of nuclear submarines. While at Electric Boat, I held engineering positions of increasing levels of responsibility, working as an Engineer, Senior Engineer and Engineering Supervisor. I supported engineering activities associated with the design and construction of the first *Virginia* class attack submarine, several engineered refueling overhauls of nuclear submarines as well as simultaneous conversions of *Ohio* Class (Trident) ballistic-missile nuclear submarines into multi-mission, guided-missile nuclear submarines.

Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE THE PUBLIC SERVICE COMMISSION OF SOUTH CAROLINA ("COMMISSION")?

A. No. I have not previously testified before the Commission.

Q. WHAT IS THE MISSION OF ORS?

A. ORS represents the public interest as defined by the South Carolina General Assembly as:

> [T]he concerns of the using and consuming public with respect to public utility services, regardless of the class of customer, and preservation of continued investment in and maintenance of utility facilities so as to provide reliable and high-quality utility services.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. The purpose of my testimony is to set forth ORS's recommendations resulting from ORS's examination and review of Duke Energy Carolinas, LLC's ("DEC" or "Company") power plant operations used in the generation of electricity to meet the Company's South Carolina retail customer requirements during the review period. The review period

includes the actual data for June 2018 through May 2019 ("Actual Period"), estimated data for June 2019 through September 2019 ("Estimated Period"), and forecasted data for October 2019 through September 2020 ("Forecasted Period").

Q. WAS THE REVIEW ON WHICH YOU TESTIFY PERFORMED BY YOU OR UNDER YOUR SUPERVISION?

A. Yes, the review to which I testify was performed by me or under my supervision.

Q. WHAT DID ORS'S REVIEW OF THE COMPANY'S PLANT OPERATIONS INVOLVE?

A. ORS examined various fuel and performance related documents as part of its review. These documents address the Company's electric generation and power plant outage and maintenance activities. In preparation for this proceeding, ORS analyzed the Company's monthly fuel reports including power plant performance data, unit outages and generation statistics. ORS personnel also attended site visits at the Company's Allen, Belews Creek, Buck, Cliffside, Dan River, Marshall, and W.S. Lee locations during the Actual Period. Additionally, ORS attended the NRC 2018 post-annual inspection meeting for the Catawba Nuclear Plant in Rock Hill, SC in March 2019.

Q. WHAT ADDITIONAL STEPS WERE TAKEN IN ORS'S REVIEW OF THE COMPANY'S FILING?

A. ORS met with Company personnel from various departments to discuss and review fossil and nuclear fuel procurement, fuel transportation, environmental compliance costs and procedures, emission allowances, generation plant performance, distributed energy resources, forecasting, and general Company policies and procedures pertaining to fuel

procurement. In addition, ORS monitored the nuclear, coal, natural gas, transportation and renewable industries through industry and governmental publications.

Q. DID ORS EXAMINE THE COMPANY'S PLANT OPERATIONS FOR THE ACTUAL PERIOD?

A. Yes. ORS reviewed the performance of the Company's generation units to determine if the Company made reasonable efforts to maximize unit availability and minimize fuel costs. ORS also reviewed the operating statistics of the Company's power plants by unit. Exhibit RCT-1 shows, in percentages, the annual availability, Net capacity, and forced outage factors of the Company's major generation units during the Actual Period. This Exhibit also includes the North American Electric Reliability Corporation ("NERC") national five-year (2014-2018) averages for availability, capacity, and forced outage factors for each type of generation plant.

Q. DID ORS EXAMINE THE COMPANY'S PLANT OUTAGES?

A. Yes. Exhibits RCT-2 and RCT-3 summarize outages lasting seven (7) or more days for major coal and natural gas units during the Actual Period, respectively. While not all plant outages were included in these exhibits, all outages were reviewed and found to be reasonable by ORS. Exhibit RCT-4 summarizes all outages at the Company's nuclear plants during the Actual Period. There were seven (7) separate outages involving DEC's nuclear units, including four (4) scheduled refueling outages and three (3) forced outages during the Actual Period. ORS reviewed each nuclear unit outage, except for Oconee Unit 1 reactor coolant pump seal leakage forced outage, which occurred between November 30, 2018 and December 8, 2018. The Company's investigation of the reactor coolant pump seal leakage at Oconee Unit 1 has not been completed as of the date of this testimony. ORS

will review this outage information during the Company's next annual fuel proceeding. ORS reviewed all available outage information, including associated NRC documents, and discussed these outages with Company management. The three (3) nuclear stations, which house a total of seven (7) units, achieved an overall average availability factor of 95.42% and an average Net capacity factor of 96.37% for the Actual Period, as shown in Exhibit RCT-1.

Q. WHAT WERE THE RESULTS OF ORS's ANALYSIS OF THE COMPANY'S POWER PLANT OPERATIONS FOR THE ACTUAL PERIOD?

A. ORS reviewed the Company's operation of its generation facilities during the Actual Period. ORS concluded that the Company made reasonable efforts to maximize unit availability and minimize fuel costs.

Q. DID ORS REVIEW THE COMPANY'S GENERATION MIX DURING THE ACTUAL PERIOD?

A. Yes. Exhibit RCT-5 shows the generation mix for the Actual Period by percentage and generation type. As shown in this exhibit, the nuclear, coal, and natural gas plants contributed an average of 53.74%, 17.23%, and 15.80%, respectively, of the Company's generation throughout the Actual Period. This equates to approximately 86.77% of the Company's generation for the Actual Period. The remainder of the generation was met through a mix of hydroelectric, renewables, purchased power, and Joint Dispatch Agreement ("JDA") purchases.

Q. DID ORS REVIEW THE COMPANY'S FUEL COSTS ON A PLANT-BY-PLANT BASIS FOR THE ACTUAL PERIOD?

A. Yes. Exhibit RCT-6 shows the average fuel costs for the major generation plants on the Company's system for the Actual Period and the megawatt-hours ("MWh") produced by those plants. The chart shows the lowest average fuel cost of 0.594 cents/kilowatt-hour ("kWh") at Oconee Nuclear Station and the highest average fuel cost of 3.527 cents/kWh at the Cliffside plant. The Company utilizes economic dispatch, which generally requires the lower cost units to be dispatched first.

Q. DID ORS REVIEW THE COMPANY'S FORECASTED POWER PLANT OPERATIONS FOR THE ESTIMATED AND FORECASTED PERIODS?

A. Yes. ORS reviewed the Company's maintenance schedules and projected performance data for its power plants for the Estimated and Forecasted Periods. ORS compared these schedules to previous maintenance schedules from Docket No. 2018-3-E and found them to be reasonable.

Q. WILL YOU UPDATE YOUR TESTIMONY BASED ON INFORMATION THAT BECOMES AVAILABLE?

A. Yes. ORS fully reserves the right to revise its recommendations via supplemental testimony should new information not previously provided by the Company, or other sources, becomes available.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes, it does.

Office of Regulatory Staff

EXHIBIT RCT-1

Power Plant Performance Data

Duke Energy Carolinas, LLC

Docket No. 2019-3-E

Coal Plants	Unit	MW Rating	*Actual Period Data* Average Availability Factor (%)	Average Net Capacity Factor (%)	Average Forced Outage Factor (%)
Belews Creek	1	1,110	86.14	47.35	1.21
Belews Creek	2	1,110	64.24	29.08	0.97
Cliffside	5	544	73.46	28.44	13.24
Cliffside	6	844	75.58	53.36	1.36
Marshall	1	370	88.30	27.51	3.31
Marshall	2	370	61.83	15.06	1.23
Marshall	3	658	80.54	44.14	10.57
Marshall	4	660	85.82	56.79	1.93
Coal Totals		**5,666**	77.29	40.08	4.51
NERC 5-year average (All Coal Plants)			***83.00***	***54.69***	***5.09***

CC Plants[1]	Unit	MW Rating	Average Availability Factor (%)	Average Net Capacity Factor (%)	Average Forced Outage Factor (%)
Buck	10	668	84.14	70.66	0.06
Dan River	7	662	93.15	78.87	0.49
WS Lee	10	786	80.92	74.52	5.45
CC Totals		**2,116**	85.30	78.64	2.77
NERC 5-year average (CC Plants)			***87.91***	***53.59***	***2.34***

Nuclear Plants	Unit	MW Rating	Average Availability Factor (%)	Average Net Capacity Factor (%)	Average Forced Outage Factor (%)
Catawba	1	1,160	93.28	95.53	0.00
Catawba	2	1,150	100.00	100.74	0.00
McGuire	1	1,158	91.59	91.53	1.63
McGuire	2	1,158	92.20	93.63	0.00
Oconee	1	847	90.89	91.25	2.05
Oconee	2	848	100.00	102.14	0.00
Oconee	3	859	100.00	101.24	0.00
Nuclear Totals		**7,180**	95.42	96.37	0.53
NERC 5-year average (All Nuclear Plants)			***92.40***	***91.38***	***1.48***

[1] *CC designates Combined-Cycle units.*

Office of Regulatory Staff

Coal Unit Outages - 7 Days or Greater Duration

Duke Energy Carolinas, LLC

Docket No. 2019-3-E

Unit	Date Offline	Date Online	Hours	Outage Type	Explanation of Outage
Belews Creek 1	10/13/18	11/2/18	490.2	Planned	Unit taken offline for a planned Fall outage.
Belews Creek 2	9/8/18	12/8/18	2,182.0	Planned	Unit taken offline for a planned Fall outage.
Belews Creek 2	4/6/19	4/30/19	580.6	Planned	Unit taken offline for a planned Spring outage.
Cliffside 5	7/18/18	8/1/18	348.8	Forced	Unit forced offline due to coolant pump failure
Cliffside 5	9/1/18	9/9/18	192.0	Planned	Unit taken offline for a planned Fall outage.
Cliffside 5	10/22/18	11/3/18	293.3	Maintenance	Unit taken offline for functional check of natural gas equipment
Cliffside 5	11/5/18	11/30/18	608.8	Forced	Unit forced offline due to low vacuum in condenser
Cliffside 5	4/29/19	5/10/19	281.9	Maintenance	Unit taken offline for wet scrubber mist eliminator maintenance
Cliffside 6	9/21/18	11/5/18	1,059.0	Planned	Unit taken offline for a planned Fall outage.
Cliffside 6	11/5/18	11/14/18	233.0	Outage Extension	Unit remained offline for circulating water pump rebuild
Cliffside 6	11/14/18	11/27/18	316.6	Maintenance	Unit taken offline to perform functional check and commissioning of natural gas equipment
Cliffside 6	4/20/19	4/29/19	216.0	Planned	Unit taken offline for a planned Spring outage.

Office of Regulatory Staff
Coal Unit Outages - 7 Days or Greater Duration
Duke Energy Carolinas, LLC
Docket No. 2019-3-E

Unit	Date Offline	Date Online	Hours	Outage Type	Explanation of Outage
Marshall 1	10/6/18	10/19/18	326.5	Planned	Unit taken offline for a planned Fall outage.
Marshall 1	4/17/19	4/27/19	240.0	Maintenance	Unit taken offline for radiant reheat tube maintenance.
Marshall 2	9/7/18	12/2/18	2,052.6	Planned	Unit taken offline for a planned Fall outage.
Marshall 2	2/23/19	4/9/19	1,088.5	Planned	Unit taken offline for a planned Spring outage.
Marshall 3	3/5/19	4/11/19	877.1	Forced	Unit forced offline due to Low Pressure Turbine Crossover piping Failure
Marshall 3	4/26/19	5/26/19	705.6	Planned	Unit taken offline for a planned Spring outage.
Marshall 4	12/7/18	12/15/18	186.0	Maintenance	Unit taken offline for Air Heater maintenance.
Marshall 4	3/22/19	4/18/19	643.2	Planned	Unit taken offline for a planned Spring outage.
Marshall 4	4/26/19	5/4/19	186.8	Maintenance	Unit taken offline for Startup Bypass System Valve maintenance.

Office of Regulatory Staff

EXHIBIT RCT-3

Natural Gas Unit Outages - 7 Days or Greater Duration

Duke Energy Carolinas, LLC

Docket No. 2019-3-E

Unit	Date Offline	Date Online	Hours	Outage Type	Explanation of Outage
Buck	3/2/19	4/18/19	1,137.1	Planned	Unit taken offline for a planned Spring outage.
Buck	4/18/19	4/26/19	189.2	Planned	Unit taken offline for a planned Spring outage.
Dan River	4/5/19	4/19/19	322.1	Planned	Unit taken offline for a planned Spring outage.
WS Lee	9/29/18	10/24/18	361.0	Planned	Unit taken offline for a planned Fall outage.
WS Lee	12/3/18	12/20/18	405.9	Forced	Unit forced offline due to Turbine low Lube Oil in Reservoir
WS Lee	3/9/19	4/11/19	811.1	Planned	Unit taken offline for a planned Spring outage.

Office of Regulatory Staff
Nuclear Unit Outages
Duke Energy Carolinas, LLC
Docket No. 2019-3-E

EXHIBIT RCT-4

Unit	Date Offline	Date Online	Hours	Outage Type	Explanation of Outage
Catawba 1	11/17/18	12/11/18	588.6	Planned	Unit taken offline for a scheduled refueling outage.
McGuire 1	3/23/19	4/16/19	594.0	Planned	Unit taken offline for a scheduled refueling outage.
McGuire 1	4/26/19	4/30/19	99.4	Forced	Unit forced offline due to 1B Turbine Feedwater Pump Turbine repairs.
McGuire 1	5/3/19	5/5/19	43.7	Forced	Unit forced offline due to reactor trip while restoring Pressurizer Heaters to Automaic Configuration
McGuire 2	9/15/18	10/13/18	683.6	Planned	Unit taken offline for a scheduled refueling outage.
Oconee 1 *	10/19/18	11/14/18	617.9	Planned	Unit taken offline for a scheduled refueling outage.
Oconee 1	11/30/18	12/8/19	179.2	Forced	Unit forced offline due to Reactor Coolant Pump 1B2 Seal Leakage.

**** Following completion of the End-Of-Cycle refueling outage 30, a turbine overspeed test was performed. Unit was briefly disconnected from the grid (1.3 Hrs.)***

EXHIBIT RCT-5

Office of Regulatory Staff
Generation Mix (Percentage)
Duke Energy Carolinas, LLC
Docket No. 2019-3-E

	2018							2019					
	June	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Average**
Nuclear	50.97	51.42	50.26	48.52	54.80	51.96	52.55	55.46	59.53	60.48	57.92	54.09	**53.74**
Coal	26.00	19.69	20.72	22.27	13.77	15.79	14.42	13.86	5.61	16.31	15.82	18.86	**17.23**
Natural Gas	15.48	18.40	15.84	16.12	15.31	18.30	13.13	16.17	19.20	12.44	11.48	16.86	**15.80**
Hydroelectric	1.90	0.21	1.63	1.45	2.83	2.33	3.41	3.33	2.55	2.80	3.26	1.17	**2.18**
Solar	0.14	0.11	0.13	0.10	0.12	0.08	0.06	0.08	0.08	0.13	0.17	0.13	**0.11**
Wind	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Biomass	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Purchased Power	3.45	3.57	5.70	7.18	6.31	5.93	8.61	7.35	5.76	3.60	6.37	6.83	**5.87**
JDA Purchases	2.07	6.60	5.72	4.37	6.85	5.60	7.83	3.75	7.27	4.23	4.98	2.05	**5.06**

Numbers may not equal 100% due to rounding.

Office of Regulatory Staff
Generation Statistics for Major Plants
Duke Energy Carolinas, LLC
Docket No. 2019-3-E

EXHIBIT RCT-6

Plant	Fuel Type	Average Fuel Cost (¢/kWh) [1]	Generation (MWh)
Oconee	Nuclear	0.594	21,976,604
Catawba	Nuclear	0.606	19,652,378
McGuire	Nuclear	0.619	18,782,490
WS Lee CC	Natural Gas	2.533	5,184,590
Buck CC	Natural Gas	2.583	4,481,538
Dan River CC	Natural Gas	2.643	4,960,930
Marshall	Coal	3.314	7,244,207
Belews Creek	Coal	3.356	7,431,915
Cliffside	Coal	3.527	5,314,992

[1] ***Includes Base Fuel and Environmental Costs.***